

Atmospheric conditions and transport patterns associated with high and low summer ozone levels in the lower troposphere and the boundary layer over the eastern Mediterranean

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Vertical summertime ozone profiles measured in the period 1994–2008 in the framework of the MOZAIC project over the Eastern Mediterranean basin (especially over the Cairo and Tel-Aviv airports) were analysed, focusing at first in the lower troposphere (1.5–5 km). The vertical profiles collected during extreme days with very high or very low tropospheric ozone mixing ratios have been examined together with the average profiles of relative humidity, carbon monoxide, temperature gradient, wind speed and the corresponding composite maps of geopotential heights at 850 hPa. As a next step, average profiles corresponding, respectively, to the highest and the lowest ozone mixing ratios for the 0–1.5 km layer over Cairo in summer are examined along with their corresponding composite maps of geopotential height (and anomalies), vertical velocity (and anomalies), specific humidity anomalies, precipitable water anomalies, air temperature anomalies and wind speed at 850 hPa as well as the corresponding backward trajectories.

Based on the above analysis, it turns out that the lower-tropospheric ozone variability over the eastern Mediterranean area is controlled mainly by the synoptic meteorological conditions, combined with local topographical and meteorological features. In particular, the highest ozone concentrations in the lower troposphere and subsequently in the boundary layer are associated with large-scale subsidence of ozone-rich air masses from the upper troposphere under anticyclonic conditions while the lowest ozone concentrations are associated with low pressure conditions inducing uplifting of boundary-layer air, poor in ozone and rich in relative humidity, to the lower troposphere. Also, during the 7% highest ozone days at the 0–1.5 km layer over Cairo, very high ozone concentrations of about 80 ppb on average are observed from the surface up to 4–5 km altitude. During the highest ozone days over both airports for the 1.5–5 km layer and over Cairo over the 0–1.5 km layer, there are extended regions of strong subsidence in the eastern Mediterranean but also in eastern and northern Europe and over these regions the atmosphere is dryer than average. The results of this study will be used within the framework of the MACC project.

References

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